5.6 Radical Expressions

Properties

$a, b, \sqrt[n]{a}, \sqrt[n]{b} \in \mathbb{R}$
m, n ∈ Z

1. $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$
2. $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$
3. $\sqrt[n]{b^m} = (\sqrt[n]{b})^m$
4. $\sqrt[m]{\sqrt[n]{b}} = \sqrt[n]{\sqrt[m]{b}}$

Ex:

$\sqrt{36}$ $\sqrt{9} \cdot \sqrt{4} = 3 \cdot 2 = 6$

$\sqrt{4^3} = \sqrt{4}^3 = 8$

$\sqrt[8]{16}$ $\sqrt[4]{\sqrt{16}} = \sqrt[4]{4} = \sqrt{\sqrt{4}} = \sqrt{2}$

Ex:

$\sqrt[3]{8^2}$ $= \sqrt{8}^2 = 2^2 = 4$

$\sqrt[3]{216} = 6$

$\sqrt[6]{64}$ $\sqrt[3]{\sqrt{64}} = \sqrt[3]{8} = 2$

$\sqrt{\sqrt[3]{64}} = \sqrt{4} = 2$

Ex:

$\sqrt[15]{32}$ $\sqrt[3]{\sqrt{32}} = \sqrt[3]{2}$

$\sqrt{\frac{7}{4}} = \frac{\sqrt{7}}{\sqrt{4}} = \frac{\sqrt{7}}{2}$

Rationalize the Denominator
(free of irrational numbers)

$$\sqrt{\frac{7}{3}} = \frac{\sqrt{7}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{21}}{3}$$

Multiply by 1

$$\frac{9}{\sqrt{b^3}} = \frac{9}{b\sqrt{b}} \cdot \frac{\sqrt{b}}{\sqrt{b}} = \frac{9\sqrt{b}}{b^2}$$

$b \cdot b$

$$\frac{4}{\sqrt[4]{27a^2}} = \frac{4}{\sqrt[4]{3^3a^2}} \cdot \frac{\sqrt[4]{3^1a^2}}{\sqrt[4]{3^1a^2}} = \frac{4\sqrt[4]{3a^2}}{\sqrt[4]{3^4a^4}}$$

$$= \frac{4\sqrt[4]{3a^2}}{3a}$$

$$\frac{2}{\sqrt[5]{2c^4}} \cdot \frac{\sqrt[5]{2^4c}}{\sqrt[5]{2^4c}} = \sqrt[5]{2^5c^5}$$

$$\frac{2\sqrt[5]{2^4c}}{2c} = \frac{\sqrt[5]{2^4c}}{c}$$

$$\frac{1}{\sqrt[5]{a^2b^3c}} = \frac{\sqrt[5]{a^3b^2c^4}}{abc}$$

$$\sqrt[5]{a^5b^5c^5}$$

$$\frac{8}{\sqrt[3]{32ab^2c^6}} = \frac{8}{2c^2\sqrt[3]{2^2ab^2}} \cdot \frac{\sqrt[3]{2a^2b}}{\sqrt[3]{2a^2b}}$$

$\sqrt[3]{32ab^2c^6} = \sqrt[3]{2^5ab^2c^6}$

$2\ 2\ 2\ 2\ 2$

$$\frac{8\sqrt[3]{2a^2b}}{2c^2 \cdot 2ab}$$

$$\frac{2\sqrt[3]{2a^2b}}{abc^2}$$

$$\frac{1}{\sqrt[3]{48}} \quad \frac{1}{\sqrt[3]{3 \cdot 2^4}} = \frac{1}{2\sqrt[3]{3 \cdot 2}}$$

$6\ 8$

$3\ 2\ 2\ 2\ 2$

$$\frac{1}{2\sqrt[3]{6^1}} \cdot \frac{\sqrt[3]{6^2}}{\sqrt[3]{6^2}}$$

$$\frac{\sqrt[3]{6^2}}{12}$$

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15-33
odd